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Brain Plasticity Related to Psychomotor Skills in Catheter-based Interventions

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Introduction

- A fascinating property of the human brain is its ability to reorganize as a result of experience
- Experimental evidence of practice-related brain change has been shown as a result of various training tasks and time schemes
- However, complex, delicate real-life tasks that involve multiple interrelated skills have not been examined yet

Endovascular Procedures

- Minimal access procedures, where a catheter is used to treat cardiovascular disease
- These procedures are cognitively challenging

Psychomotor Challenges

- Neither direct access, nor direct view to the target site
- X-ray visualization is imperfect, proprioceptive illusions
- Patient anatomy and morphology can complicate catheter steering

Research Questions

- Does training of the psychomotor skills related to catheter-based procedures cause grey and white matter change as well as increased functional connectivity? Is it behaviourally relevant?

Hypothesis

- Grey matter change in the experimental group is mainly expected in the medial occipital and parietal lobe; other areas will be explored
- Increased fractional anisotropy is mainly expected in the white matter underlying the right posterior intraparietal sulcus; other areas will be explored
- Increased functional connectivity is expected in fronto-parietal networks and cerebellar networks

References

Lanzer, P. (2013). Cognitive and decision-making skills in catheter-based cardiovascular interventions. In *Catheter-Based Cardiovascular Interventions* (pp. 113-155). Springer Berlin Heidelberg.

Scholz, J., Klein, M. C., Behrens, T. E., & Johansen-Berg, H. (2009). Training induces changes in white-matter architecture. *Nature neuroscience*, 12(11), 1370-1371.

Mentice (Gothenburg, Sweden)

Contact

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Methods

- Participants: Forty (20 controls) healthy undergraduate medical students

PROCEDURE



DAY 1



MRI Pre-Measures



Cognitive Tests

DAY 2



Video Instruction



Training on the Simulator

DAY 3

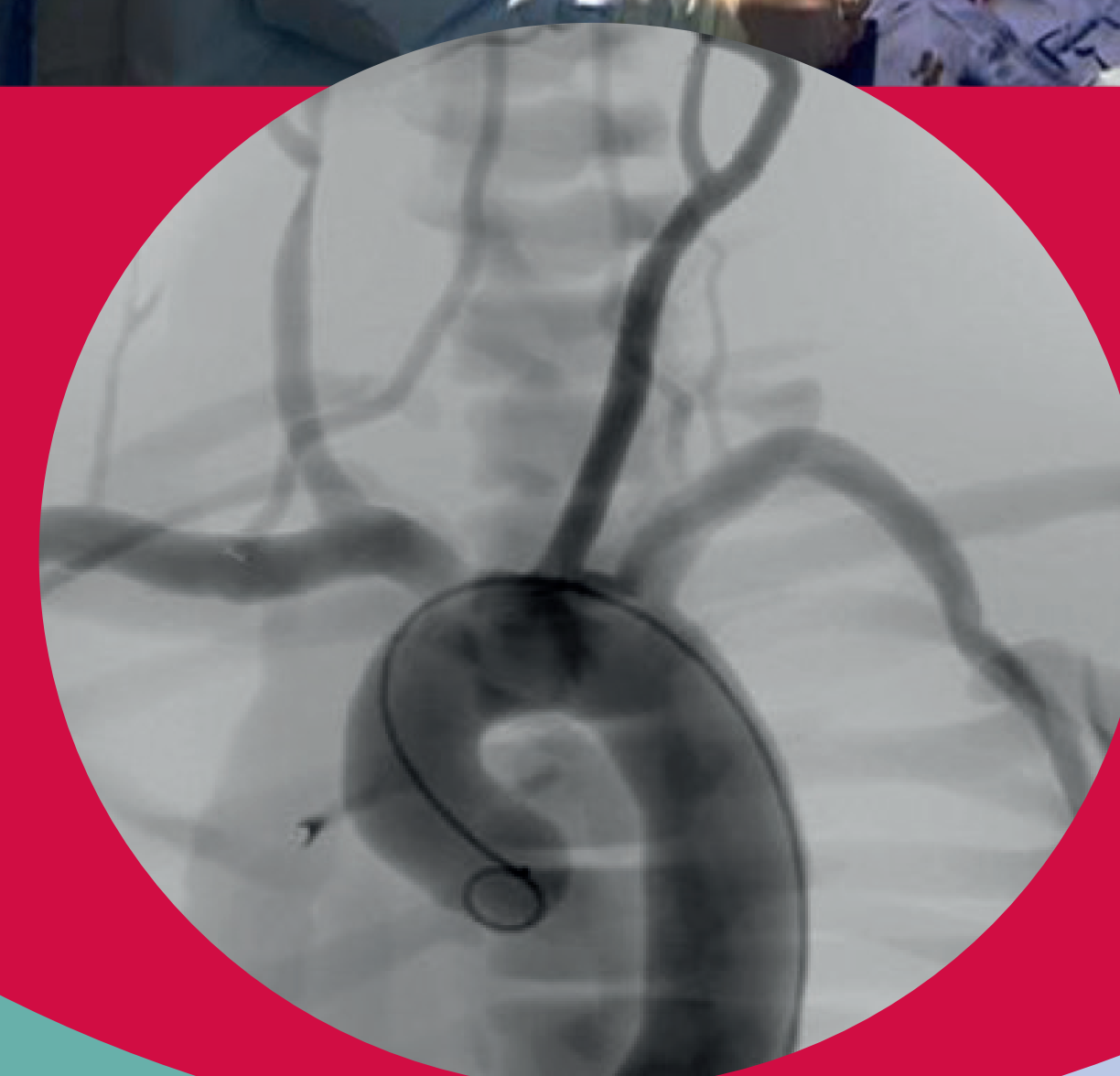


Psychomotor Training on Mentice VIST G5 Simulator



MRI Post-Measures

Operator conducting an endovascular procedure. The circles show catheter steering under fluoroscopy



Psychomotor Training

Participants will train attaining access to the internal carotid artery on the endovascular simulator VIST G5 (Mentice, Gothenburg). The complexity of the training cases will increase after a predefined skill level is mastered

Measures

Behavioural

- Movement economy
- Catheter handling errors
- Radiation exposure and amount of contrast agent used

Neuronal

- Change in grey matter (T1-weighted scan)
- Change in white matter (diffusion weighted scan)
- Change in functional connectivity (resting-state fMRI)

Cognitive

- Mental rotation skills, task-switching ability and cognitive control



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